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THE IMPORTANCE OF INSTITUTIONS IN LONG TERM GROWTH

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Executive Summary

Transforming a pre-industrial economy into a modern high-income economy will certainly require substantial capital inputs **and a** labor force with an adequate educational level. But the accumulation of physical and human capital are not sufficient **conditions for productivity growth in developing economies.** There are many economies that have emphasized the accumulation of these inputs but have not achieved successful development.

Neither old growth theory nor new growth theory provides a good explanation of why some developing countries have achieved rapid **growth and others have not.** The old growth theory is broadly consistent with the data, **but the tendency towards convergence** predicted by that theory is very weak in practice. The new **growth theory predicts that the fastest growing countries will be** the highest income countries and this is inconsistent with observation. It is difficult to use either theory to describe developing country growth when there are often zero or negative **rates of total factor productivity growth.**

Versions of new and old growth theory that suggest a very large role for education in development appear to be strongly inconsistent with observation. The rate of accumulation of human **capital is negatively correlated with productivity growth. A number of** countries that have emphasized human capital **accumulation have large negative total factor productivity residuals.**

This paper suggests that economic institutions play an important role in explaining why some economies have grown successfully and others have not. Evidence from recent studies of productivity in developed economies and in Latin America supports this view. For example, the reason that capital accumulation does not guarantee economic growth is illustrated by Latin American countries where large investments in steel-making facilities have resulted in plants that have never been made operational; Further investment **in human capital accumulation in Latin America may be of limited** value given that the existing skills of the work-force are not **being utilized effectively because of inefficient state-owned or** regulated companies.

The geographic pattern of economic development is indicative of the importance of institutions. Economic development spread from Britain to North America and Australia, **aided by common language** and institutions. It spread more slowly to adjacent continental European countries.

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by

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Introduction

The theory and empirical analysis of long term growth has given rise to an explosion of literature in the last few years as a result of the coming together of three sets of ideas and/or results. First, the empirical analyses of William Baumol, Edward Wolff and Angus Maddison pointed clearly to economic convergence among the major industrial countries.[1] This convergence finding was then linked to a key prediction of the neoclassical growth model, namely that economies converge to steady state growth paths.

Second was the development of new data sets that covered a much broader range of countries than were available previously.[2] These data indicated clearly that simple convergence had not taken place for larger groups of countries. The data also provided a variety of additional information about developing countries that spawned an empirical literature seeking patterns in the growth process.

Third was the development of new theoretical models by Paul Romer and Robert Lucas and others that stressed the importance of externalities and that linked the new empirical results to a failure of the neoclassical model.[3] The presence of externalities can give rise to increasing returns, either locally (the growth of cities or of industry clusters like Detroit or Silicon Valley) or at the national or international level (as an explanation of why rich countries keep their productivity lead).

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[1] See William J. Baumol, Richard Nelson and Edward N. Wolff eds. (1994) and the Festschrift for Maddison edited by Adam Szirmai, Bart van Ark and Dirk Pilat (1993).

[2] Robert Summers and Alan Heston and others of the U.N. International Comparisons Project and also the World Bank.

[3] See Paul Romer (1986), Robert Lucas (1988). Brian Arthur was one of the first to stress increasing returns.

The interest in externalities has been reinforced by a literature that has used this assumption in models of short term fluctuations. Either technological externalities or pecuniary/demand externalities can be used to model business cycle fluctuations. In the long term growth literature, countries that (for some reason) are able to initiate a period of rapid growth are able to benefit from spillovers within the country that then facilitate further rapid growth, Success breeds success. In the business cycle literature, a decision (for some reason) by firms to produce at high levels creates a favorable climate for production, either for aggregate demand reasons (production creates demand) or for technological reasons (production by one firm raises productivity in other firms). Again success breeds success.

This paper will argue that both the old growth theory and the new growth theory share a common and important limitation. Neither has provided insight into the reasons. why some developing countries have grown rapidly and others have not.[4]

The old theory is correct in arguing that there are diminishing returns to capital and constant returns to the factors of production as conventionally defined. When the new growth theory proposes increasing returns to these standard factors of production it is therefore incorrect. But the new growth theory is correct in pointing to the incompleteness of the old theory and in arguing that externalities are important. The paradigm of "success breeds success" does appear to apply to the process of economic development.

The framework of analysis of both the old and the new growth theories is of economies that operate on the frontier of a production function and the debate over theory is about the nature of that frontier. I will argue instead that economic growth in developing

[4] Parenthetically, it is also the case that neither theory has provided much insight into the other big growth puzzle, namely why growth has slowed in the advanced countries since 1973 -- that is a different topic, however.

countries is not well-described by such a framework.[5] Many or even most of the countries have had little success in economic development. Conventional growth accounting indicates that many or even most of the countries have experienced very low or even negative total factor pruductivity (TFP) growth. Determinants of performance other than traditional factors such as capital and labor are the key to understanding successful economic development.

Policies and institutions are the underlying reasons why some countries have succeeded in generating rapid growth and others have not. To the extent that there are externalities in economic growth, these are probably associated with the example of successful policies and institutions that are applied to proximate countries.

A country that finds a way to increase the rate of investment in physical capital or the rate of accumulation of educational capital may not achieve sustained economic growth if its incentive structure is wrong. And a country that maintains market incentives, preserves property rights and encourages competition may not need to use active policies to encourage the accumulation of human and physical capital, since these are likely to occur naturally, if the incentives are correct.

This argument about the underlying drivers of economic growth is not fully supported or realized in this paper. I will not be able to provide definitive evidence for the viewpoint taken. There is some suggestive evidence, however. First, data has been prepared on the rate of capital accumulation and human capital accumulation for a much larger group of countries than was available until fairly recently.[6] Second, the fact that geography is strongly

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[5] This point is also argued in Mancur Olson (1993)

[6] See Vikram Nehru and Ashok Dhareshwar (1993) and Vikram Nehru, Eric Swanson and Ashutosh Dubey (1993). The data is available from the World Bank.

associated with success in economic development provides direct support for the view that externalities are important. Third, I will review evidence from a variety of different case studies that helps reveal the sources of high productivity among developed country industries and the characteristics of developing country industries whose productivity is very low.

What Are the Key Empirical Predictions of the Old and New Theories?

The original neoclassical growth model was designed to demonstrate that the knife-edge instability predicted by the Harrod-Domar model was not a valid prediction for an economy where capital-labor substitution was possible. Adjustments of the capital output ratio would allow economies to converge to paths of steady-state growth. The principal empirical findings of the model were first that, with the addition of labor-augmenting technical change, it was consistent with Kaldor's famous stylized facts of growth; and that second, most of the growth of labor productivity over time was not the result of increases in the ratio of capital to labor but was the result of technological change. In other words, it was found that most of the time-series variance of productivity was unexplained by the time-series variance of the ratio of capital (measured by the stock of equipment and structures) to labor. This conclusion was reached using the capital-income share as the estimate of the capital elasticity, but time-series econometric estimates did not generally suggest a much larger coefficient on capital than this, in fact the estimates were often smaller.

This simple neoclassical growth model cannot explain much of the variance of either the level or the growth rates of output per worker across a broad group of countries that includes developing countries. Robert Lucas demonstrates this point with particular force.[7] He says that if the level of technology is really exogenous, then it should be the same in all countries. That implies that the only reason for differences in output per worker are differences in capital per worker.

As a case study, Lucas uses India. He notes that output per worker is about 15 times as large in the U.S. as it is in India. He does not have a direct estimate of the amount of capital per worker, but he notes that with a capital coefficient of 0.4 and a Cobb-Douglas production function, there would have to be so much capital in the U.S. relative to India that the rate of return to capital would be 58 times as great in India as it is in the U.S. His numbers imply that capital per worker would have to be 870 times as great in India as in the U.S. This combination of rate of return and ratio of capital per worker is implausible and inconsistent with observation.

Lucas is rediscovering the old growth paradox in a different form. The production function is as shown in Equation 1

$$q = Ak^{\alpha} \tag{1}$$

Where q is output per worker and k is physical capital per worker. With this function and a modest capital coefficient Solow found in 1957 that the bulk of the increase in labor productivity over time must be the result of changes in technology, that is to say, in changes in the A term in the production function. Lucas is finding (for the same reason) that the variance of labor productivity in the cross-section must also be the result of differences in A.

[7] Robert Lucas (1990)

When Solow's puzzle appeared there was surprise and some concern because so much of growth was assigned to an unexplained residual. Indeed Moses Abramovitz had developed his own version of the same puzzle and he described the residual as a measure of our ignorance. Nevertheless, we have been willing to live with the time-series puzzle because it was natural to think of A as rising over time, given the continuous world-wide effort to increase pure and applied knowledge. And of course Zvi Griliches, Dale Jorgenson and Edward Denison worked hard to explore R&D and education and other elements that could help explain the residual. Lucas's puzzle is posed very starkly because he assumes that technology must be the same across countries.*

One way out of the paradox is human capital. Suppose the production function is as shown in Equation 2.

$$q = Ak^{\alpha}h^{\beta} \tag{2}$$

Where h is human capital per worker. Take the Mankiw-Romer-Weil estimates' of about one-third for both a and ß, and an estimate by Ann Krueger (cited by Lucas) to the effect that US. workers on average have enough human capital to make them equivalent to 5 Indian workers (h=5). Substitute this value in and then ask what must the relative U.S./India capital labor ratio be in order to give the ratio of 15 for the ratios of output per worker. The answer

[8] It is not clear that this assumption is correct. The availability of technology is not the same as the ability to use a technology in production. To support Lucas argument at this point, however, Mancur Olson has pointed out that if the problem were really a matter of lack of technological information, then there are experts available in the world that could transfer the technology.

[9] Gregory Mankiw, David Romer and David Weil (1992).

is that the capital labor ratio in the U.S. must be 675 times that for India and the rate of return to capital in India would then be 45 times that for the U.S. So this production function and this much human capital do nót do the trick.

Perhaps human capital differences are greater than Krueger's estimate. One can ask how many Tndian workers must be equivalent to one U.S. worker in order to equalize rates of return to physical capital between the countries. The answer to that is 225 Indian workers equals 1 U.S. worker. That is possible, but clearly the Mankiw-Romer-Weil production function has a tough time solving the Lucas paradox.

Lucas himself solves it with the assumption that there are external effects of human capital. He assumes an externality such that a 10 percent increase in the amount of human capital in the whole population other than a given worker will raise that worker's productivity by about 4 percent. This implies a value of about unity for ß in the aggregate production function. With Krueger's estimate of 5 to 1 as the human capital ratio, this means that a ratio of 15 to 1 in labor productivity can be made consistent with about the same capital output ratio in both India and the U.S. and hence the same rate of return in the two countries, if the capital elasticity, a is around 0.4.

To support the idea that there are human capital- externalities of the magnitude he has assumed, Lucas shows that the same human capital externalities also eliminate the Denison residual in the time-series pattern of U.S. growth. His model is therefore consistent with both the time-series growth paradox and the cross-sectional growth paradox. By linking the two observations, he provides support for the idea of human capital externalities.

Although it is possible that human capital externalities are at work, the linking of the cross-section and time-series puzzles is not conclusive. What is evident is that A in Equation 1 cannot be the same in advanced countries like the U.S. and developing countries like India. What is not evident is where the difference comes from. The reason that the time-series and cross-sectional puzzles work out neatly is that the capital output ratio has remained reasonably constant over time in the U.S. (or it did over the time period of Denison's analysis). Lucas's solution to the U.S./India paradox involves finding parameter values such that the rates of return to physical capital are the same in the two countries. In a Cobb-Douglas framework, a constant rate of return implies a constant capital output ratio. This means that solving one paradox will also solve the other.

The key attribute of the Lucas specification of the production function is that it suggests a very high social return to education. It predicts that countries that invest heavily in education will grow rapidly and that variations in the average level of education will not lead to variations in the return to education." I will show Iater that the first of these predictions seems clearly false. The second also seems incorrect for the U.S. economy. The return to higher education fell in the 1970s when the number of new college graduates rose very rapidly and has risen in the 1980s when that situation changed.

Lucas has emphasized human capital as the source of production externalities, but in Paul Romer's analysis he suggests/several possible sources as he searches for the most sensible specification within a class of models that he feels is important. Most importantly, he has suggested physical capital and knowledge or R&D capital as possibilities for generating externalities and he has written down elegant and appealing models that combine

[10] Of course even in a standard Solow model, there is no necessity for capital accumulation to drive down the rate of return. In Solow type models the rate of return will fall if the capital output ratio is increased.

constant returns at the micro level, market power by developers of proprietary technology and increasing returns at the aggregate level.

The primary prediction of models with endogenous growth and increasing returns is that there will be no decline and may be an increase in the rate at which the productivity frontier moves out. And the evidence, Romer has suggested, supports this. Since productivity increase must come from some purposive economic activity, he argues, it must be attributable to some form of capital accumulation. Since additions to this capital have not been accompanied by declining growth, there must be at least constant returns to this form of capital and hence increasing returns overall."

This prediction does not provide a direct test of this model against the old growth theory. There is nothing in the old growth theory that says that the rate of technological change has to be constant over time. It could speed up, as seems the case when comparing growth in this century with growth in earlier centuries. Or it could slow down, as seems consistent with the experience of the U.S. and other OECD countries when comparing the period after World War II with the period since 1973. So to distinguish the two theories we need some evidence as to whether technological change is exogenous or endogenous. For many theorists, Romer's argument for endogeneity seems self-evident. Indeed the same idea seemed self-evident to theorists in the 60s who developed models of growth with R&D.[12] But from an empirical viewpoint the issue is far from obvious.

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[11] Robert Solow (1994) has pointed out that the new growth models suffer from a knife-edge problem. Unless the returns to capital are exactly unity, the models predict either that growth will cease or that output will expand to infinity in finite time when saving is a constant fraction of income. The former case means we are back to a model that is similar to the old growth theory, while the latter case seems highly improbable.

[12] See for example Hirofumi Uzawa (1965).

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Technological change is best modelled as endogenous if we can demonstrate that it is linked directly to observables. It is best modeled as exogenous if it is unrelated to any variables that can be measured. Saying that technological change cannot possibly come out of nowhere does not make it endogenous in models of country growth. The world-wide pace of scientific and technological advance is largely exogenous to the business sector of any single country. It is not even clear how closely related it is to the level of scientific effort world-wide, given the importance of serendipity in science. The growth of practical knowledge of economic value within a given economy, on the other hand, is surely related to activities within that economy. That strongly suggests that for any individual country, there are likely to be both endogenous and exogenous components to technological change. The relative importance of the two components may vary depending upon whether one is studying the U.S., a country that contributes a large fraction of the world-wide advance in knowledge, or a small developing country where the frontier is determined externally.

The case of the U.S. economy is particularly interesting in terms of evaluating the role of R&D and innovation in growth. Since World War II, the U.S. has had a high ratio of R&D to GDP compared to other countries and, given its size, has carried out by far the largest absolute amount of R&D. The U.S. has contributed by far the largest fraction of important technological innovations of any country and has accounted for most of the innovations in the service sector. At the same time, the U.S. has had one of the slowest rates of growth of any of the industrial countries.

The easiest Romer model to test directly is the one that specifies externalities to physical capital. This makes predictions that are analogous to the ones that Lucas makes, namely that countries that accumulate physical capital rapidly should grow very rapidly and that the return to physical capital should not vary with variations in the rate of capital accumulation. I will show later that indeed capital accumulation appears to be important as a source of growth, but not more important than its income share would indicate. And Charles Schultze and T found that variations in the rate of capital accumulation over time in the U.S. did appear to be correlated with variations in the rate of return to capital.[13]

In specifications where he is stressing knowledge capital rather than physical capital, the empirical implications of Romer's analysis are less clear. There is clear evidence of externalities to R&D in the U.S., with social rates of return estimated to be 2 to 4 times the private rate of return.[14] And given the size of the R&D stock for the U.S., this would imply returns to scale of about 1.12. Incidentally, this is about the extent of increasing returns to scale suggested by Denison for the U.S., although Denison does not emphasize R&D. This is not a trivial amount of increasing returns, but is not enough to give constant returns to capital. In particular, it is not possible or even likely that there will still be steady state growth with returns to scale at this level.[15]

Romer has suggested foreign direct investment as a source of knowledge for individual countries and that growth is then related empirically to the amount of such investment. This is a plausible idea, although its implications do not necessarily go in the direction that the new growth theory might choose. It highlights the point I made above, namely that for most

[13] Baily and Schultze (1990)

[14] See Baily and Chakrabarti (1988) for a discussion of this point and a review of evidence.

[15] At the international level, Frank Lichtenberg has found that R&D investment is related to productivity differences. He uses a version of Mankiw-Romer-Weil study, and I will discuss these results shortly.

small countries the technology frontier is determined in the rest of the world.

Finally, there is a serious question about whether the long term historical evidence really supports Romer's view of economic growth.[16] Romer notes that there is no systematic tendency for the poor countries as a group to grow more rapidly than the rich countries and interprets this as evidence against the old growth models. But actually Romer's models go beyond this to make the prediction that the richest country or countries should always be the most rapidly growing. And this is clearly at variance with observation. There is a marked historical tendency for the most rapidly growing country or countries to be a small group of catch-up countries. For example, the richest country after World War II was the United States and this has had much slower growth than many European countries and Japan.

So what is the bottom line on the new and the old growth models? The "unexplained residual" was a troublesome feature when the old growth theory was applied to time-series data for developed countries. It becomes a massive gap in the theory when we try to explain cross-sectional productivity differences.

But the new growth theory has done a better job of showing the incompleteness of the old theory than it has in providing an alternative explanation of cross-sectional variance. We need to know why some countries achieved much higher rates of total factor productivity growth than others and why some countries achieved much higher rates of accumulation of productive factors than did other countries.

What Has the Empirical Literature Shown?

[16] This point was made by Mancur Olson in comments on an earlier version of this paper.

The most frequently used specification of the “productivity” equation for large samples of countries is as follows.

(3) Per Capita GDP,, = a + b(Investment Share) + c(Educ. (1960) or an average)

+ d(Per Capita GDP,,,) + e(Population Growth)

+ f(Other variables)

Per capita GDP is measured in logs and many of these regressions subtract “Per Capita GDP_{60}" from both sides of the equation. This does nut result in a substantively different specification. Almost all of the results reported find that the average investment share over the period 1960-85 is a major contributor to final per capita GDP. And Bradford DeLong and Lawrence Summers have suggested that this correlation is much stronger for the equipment part of investment than for structures.” They interpret the large coefficient on equipment as a structural parameter of the production technology, indicating externalities from such investment and providing support for Romer’s models. The initial level of education also appears strongly in the results, although separate variables for primary and secondary education behave somewhat capriciously. The importance of education to growth is viewed as supportive of Lucas’s models in which there are educational externalities.

Azariadis and Drazen (1990) do not run regressions of the kind shown in Equation 3, but they do make the striking observation that no country has grown rapidly without achieving a minimum level of education. It does appear that achieving a reasonable level of educational ability is a necessary pre-requisite for growth -- a finding that makes eminent

[17] Bradford DeLong and Lawrence Summers (1991).

sense."

With the equation written as in (3), the coefficient on initial GDP per capita is less than unity once investment and education are included in the equation, and this result is interpreted as supporting the convergence hypothesis. The idea that mere is conditional convergence has been widely, although not universally, accepted." Population growth appears with a negative *sign*. With given rates of education and physical capital formation, rapid population growth will reduce per capita income growth in almost any theory.

There is of course a wide variety of "other variables" that have been tried in the regressions. They include measures of fiscal policy (government consumption or investment); monetary policy (money growth or inflation); trade policy (black market exchange differentials or trade shares or direct foreign investment or equipment imports); and distortionary domestic policies (proxies for free capital markets or property rights). The performance of these horses has depended a good deal on the riders, and there is less consensus about the results. In general, however, there is support for the idea that government can fail to provide an economic environment to sustain growth and/or that government can create serious problems for economic development. This shows up in the negative effects of trade restriction indicators, such as the black market premium, and in the DeLong-Summers results when they find very high equipment prices negatively related to growth. Government investment in infrastructure, it appears, may have some positive

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[18] I will argue, however, that the effect of the accumulation of human capital on growth once this minimum is reached can be questioned.

[19] If 1960 per capita GDP is subtracted from both sides, the coefficient on this variable is then negative and significant, indicating a growth advantage' from starting below the average level of productivity.

benefits.

One interesting set of results comes from Fischer (1993), who reports that high rates of inflation are associated with low or negative rates of GDP growth. He tests this in a regression framework like that in Equation (3), but his result appears to be strong enough to emerge from the data even without econometric controls. Looking at the World Bank's list of low and middle income countries, one is struck by the number of these countries where inflation is in double or triple digits and where growth is poor.[20] I do not want to exaggerate the conclusion however. There are countries with poor growth and low inflation and countries with good growth and high inflation. Low inflation is neither necessary nor sufficient for rapid growth, although Fischer suggests that moderate inflation may be necessary for <u>sustained</u> rapid growth.

Although there is broad agreement about the importance of the five basic variables in the productivity equation, there is little agreement about the interpretation of the results and whether they are really supportive of the old or new growth theories. As I noted above, the investment and education variables have been interpreted as providing support for models of growth with externalities. And there are examples of "other variables" that also are cited for the same purpose. Direct foreign investment or equipment imports are seen as vehicles by which countries can capture spillovers from knowledge capital created overseas.

The same basic equation is used by Mankiw, Romer and Weil, however, to argue that the neoclassical growth model fits the data well even when LDCs are included. The disagreements really turn on the <u>magnitudes</u> of some of the coefficients. Is the coefficient on

[20] Tbe World Bank, <u>World Development Report,</u> Table 1, pages 2 18-219.

capital too high to be consistent with the neoclassical model? Mankiw, Romer and Weil say no and DeLong and Summers say yes. This is tough test that puts a lot of weight on the ability of this data set to identify structural parameters.

There is a serious question about the exogeneity of the causal variables. Mankiw, Romcr and Weil, for example, report a strong correlation between the level of human capital and the level of per capita income. That is hardly a surprise. Presumably one could find a pretty strong correlation between the per capita income and the consumption of autos or many other items, with the causality going the other way. Even population growth can be seen as endogenous.

A particularly striking example of the dangers of giving a structural interpretation to the estimated coefficients has been provided by Auerbach, Hassett and Oliner (19.92). They have shown that if the DeLong-Summers sample of countries is separated into developed and developing countries and if Botswana is excluded from the list of developing countries, then the DeLong-Summers result on equipment investment largely disappears. In fact neither equipment nor structures shows up as a significant dctcrrninant of growth for either group of countries. Auerbach, Hassett and Oliner argue that separating the two sets of countries is appropriate because the nature of the growth process, or at least that the parameters of it will be very different in the two groups. And excluding Botswana is appropriate, they argue, since both the growth of GDP and the high rate of investment in that country are accounted for by the discovery and development of diamond deposits.

Botswana is providing a good example of how an excluded variable can give rise to a correlation that is not causal. The "exogenous" determinant of growth was the discovery of exploitable diamond deposits. This event then lead to both high growth of GDP and to a high level of investment.

Auerbach et al. probably overstate their own case. DeLong and Summers have done a lot of sensitivity analysis and they already pointed out the strong impact of Botswana. DeLong and Summers report that Zambia pulls down the equipment coefficient, so that it may be that excluding both countries would still leave a significant coefficient on investment.[21] It is very plausible that high investment in equipment would be an important concomitant of high economic growth -- how would any country grow rapidly without this? But the danger revealed here is that the correlation does not reveal underlying causality and the magnitude of the coefficient on investment does not really reveal the existence of externalities.

The idea of conditional convergence is widely accepted, both because the data seem to support it and because it is intrinsically very plausible. Countries at or near the frontier of technology or production methods' will find it hard to push out that frontier whereas buying technology that has been developed elsewhere or copying the production methods used by others seems easier. But even this result has been questioned. Zvi Griliches has pointed out that the test of the convergence hypothesis involves adding a lagged dependent variable to the productivity equation.[22] What has been observed is that the confidence interval on the coefficient d lies between zero and unity. But Griliches notes that this is usually what is found with lagged dependent variables and structural interpretations of the result are perilous. The fact that the coefficient is greater than zero would certainly be expected. Per capita

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[21] See the response by DeLong and Summers (1993).

[22] This is based on a conversation. See also Frank Lichtenberg (forthcoming).

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incomes were spread over a huge range in 1960 and change proceeds slowly so that initial rank will carry information about final rank. The fact that the coefficient on prior income is less than unity could reflect the fact that there are many economic variables that will move countries up or down the productivity rankings that are excluded from the equation *or* are proxied imperfectly, so that initial rank does not carry over one for one into final rank, even after controlling for the determinants of growth. This conclusion is strengthened given that initial and final levels of per capita income are measured with substantial error.

So what is the bottom line on the empirical studies ? The availability of new data has allowed exploration of the observable characteristics appear to be correlated with rapid growth or slow growth. But the literature has been misleading in suggesting that simple specifications can explain the cross-sectional variance in growth performance and that the data are really consistent with theory, old or new. Neither of these statements is correct. The variables that have been included in these regressions do not explain well why some countries grew much faster than others and even if they did, there would remain the question of why countries differ so greatly in these observed characteristics.

I turn now to some additional empirical analysis, using the growth accounting framework in which the growth of output is decomposed into contributions from capital, labor and human capital and the unexplained residual. This approach reveals some weaknesses of the existing framework for growth,analysis as applied to developing countries. There has been some prior literature that has taken this approach, notably papers by Benhabib and Spiegel (1992), Pack (1992) and Fischer (1993), so that the results given here are not brand new. But there are some lessons that can be added to what has been said in prior work.

Measuring Growth Performance

Stanley Fischer, using World Bank data, constructs three sets of estimates of TFP growth over the period 1961-88 for a sample of developed and developing countries. The first he calls a "Solow residual" calculated as the rate of growth of output minus 0.4 times the growth of capital input minus 0.6 times the growth of the labor force. The second he calls a "Mankiw-Romer-Weil residual" (hereafter MRW) calculated similarly to the Solow residual except that capital's elasticity is 0.333, and so is labor's elasticity and the same elasticity is applied also to an estimate of the growth of human capital. The third residual is a "Bhalla residual" that is the same as the MRW residual except that it uses cross-sectional estimates of the factor elasticities. Fischer chooses the Solow residuals for his own exploration of the role of inflation.

The Bhalla residuals and the Solow residuals are very close, so that for TFP, I concentrate on the Solow and the MRW residuals. There is also some advantage in looking at the simple output per worker measure of productivity, so that there are three different measures of growth performance 1961-88 for 75 countries, two TFP measures and labor productivity growth.

- Labor productivity growth measured by GDP growth minus labor force growth.
- TFP growth from a Solow residual.
- TFP growth from a MRW residual.

Capital, Education and Convergence

Table 1 gives the standard deviation and the range for the three growth measures. The first row shows that the mean rate of labor productivity growth was 1.90 percent a year for this group of countries, 1961-88, with a standard deviation of 1.46 percent. The fastest growth rate in this sample was 5.59 percent a year for Taiwan and the slowest growth rate was -1.54 percent a year for Mozambique. This gives range of outcomes of 7.11 percent.

The mean growth rate for the Solow residual is only 0.06 percent, essentially zero. So according to this group of countries, there is no residual growth on average. The puzzle that Solow found in 1957 that most of the increase in labor productivity in the U.S. economy seemed to be coming from unexplained or exogenous technological change is not apparent in this data for a large group of countries when the elasticity of physical capital in the production function is 0.4 -- higher than that used by Solow or by Denison. It has been argued that looking at growth in a cross-section of countries leads one to look for endogenous sources of technological change and then to argue that there are increasing returns. But there is no endogenous growth to be explained here.

With an elasticity of 0.4, physical capital accumulation alone has reduced the mean growth rate to zero. Dut the cross-sectional variancc and the range are reduced by only about 20 percent. The fastest grower according to the Solow residual is Brazil at 1.98 percent and the slowest is Haiti at -3.73 percent. Capital has not explained much of the cross-sectional variance in growth across this group of countries.

The results for the MRW residual are troubling. The mean growth rate is negative and about two-thirds of the countries have negative residuals. The standard deviation and the range are greater than for labor productivity, so the MRW production function has spread out the cross-sectional variation. The number one MRW growth country is Tanzania at 2.68

percent a year while the bottom of the MRW ranking is Bangladesh at -5.24 percent.

Table 2 presents correlations among the different growth measures and between these and the components of growth -- growth of human capital per worker (growth of average education); growth of capital per worker; and growth of the labor force. The correlations among the three growth measures is pretty high, especially that between the Solow residual and the MRW residual. Labor productivity is weakly negatively correlated with growth of average education level, strongly positively correlated with growth of capital per worker and negatively correlated with growth of the labor force. The Solow residual is negatively correlated with the growth of average education and virtually uncorrelated with the other elements. The MRW residual is strongly negatively correlated with education and weakly negatively correlated with labor force growth.

These results are not supportive of the hypothesis that the accumulation of human capital in the workforce is a major source of economic growth. There is no evidence that countries with strong growth were countries that achieved rapid increases in the average educational level of their labor forces.

In the appendix I show the rankings of the 75 countries for all of the growth measures and elements of growth. Perhaps the most striking pattern from the rankings is that *the countries that are in the bottom 25 of the rankings according to MRW include the top 10 performers in terms of growth of education.* This finding is consistent with the view that those countries that pushed education without getting the incentives correct did not get the growth benefits from the investment.

Simple correlations can be deceptive of course, so that I show below the result of a regression of the Solow residual on the growth of capital, labor and human capital. I have also included initial level of education and initial level of GDP per capita, since these have been seen in prior empirical work to be important contributors to growth.

$$\underset{(1.1)}{\text{Solow} = 0.0192} - \underset{(-0.16)}{0.0089}\,\text{Cap. Grow.} - \underset{(-1.26)}{0.0865}\,\text{Hum. Cap. Grow.} + \underset{(0.16)}{0.0536}\,\text{Lab. Grow.}$$

$$+ \underset{(2.26)}{0.00187}\,\text{Init. Educ.} - \underset{(-1.36)}{0.00336}\,\text{Init. Inc.}$$

Adj. R sq. = 0.135 N = 75 Period of growth 1961-88.

Given Cobb-Douglas, this regression just shows deviations from Fischer's version of the Solow production function. The results indicate that the data accept this function. The coefficient on capital is essentially zero, indicating that the assumed figure for the capital elasticity of 0.4 is close to the unconstrained estimate. The coefficient on human capital accumulation is negative but insignificant; and the labor elasticity is found to be insignificantly different from the assumed value of 0.6. Overall returns to scale are below unity (0.958) as a point estimate but not significantly so. There is no evidence of increasing returns in this data.

Initial education appears to/make a clear positive contribution to growth, so this data confirms a pattern that has emerged in the literature on growth. Human capital accumulation seems to make no contribution to growth, but starting with a high level of education is important. A country that had a level of education one standard deviations above the mean in 1961 grew at 0.5 percent a year faster than average, according to this estimate.

It seems clear that we do not yet fully understand the role of education in growth. Common sense tells that some minimum level of education of the workforce is necessary in order to make use of modem production processes in both manufacturing and service industries. And the data support this common sense. But the weak performance of the human capital accumulation variable suggests that lack of education was not the binding constraint on growth for the most part. This is confirmed below when I look at case studies of Latin America.

Subject to the caveats about how to interpret such a regression, there is modest support for convergence. The coefficient on initial income is not very significant but the estimated magnitude of the effect is non-trivial. A country that started one standard deviation below the average in income in 1961 grew 0.3 percent a year faster than average over the period.

This amount of convergence hardly makes a rapid equalization of incomes seem likely anytime soon, however. There are many countries with Solow residuals that are negative (the U.S. residual is small but positive in this data). And many of these countries are low income countries -- Haiti, Mali, Sudan, Mozambique, Senegal and Zambia make up the bottom five Solow residuals. Trinidad and Tobago and New Zealand are the only countries in the bottom third of the Solow rankings that started with above average income in 1961.

I have not included any geographic variables in the regression, but there is some indication in the data of a link between geography and growth. I explore this issue now.

Geography and Economic Performance

The 1991 World Bank Report showed the distribution of 1990 per capita income around the world, excluding the former Soviet Union and some eastern European countries. The strong geographic association is evident in their figure. *With the exception of Japan, all of the high income countries are either European or English speaking.* And even though

Japan is an exception to the rule, it is an exception that supports the pattern. After World War II, Japan was occupied by the U.S. and many U.S. institutions were introduced. After that Japan undertook a single-minded policy of adopting western ways for its economy and in some cases improving on them.

The mid-income countries are also highly concentrated: in Central and South America in a band around the Mediterranean and in Southern and Western Africa. The low-income countries are in Central Africa and Central Asia.

Over their past histories, it is clear that the European countries have achieved either faster or more consistent growth than other areas and the links of this to culture and geography have been suggested many times, including of course by Max Weber.

If we look at economic growth over the period 1961-88 the picture is somewhat different. The fast and slow growth countries are much more scattered around than the 1990 level data indicate. But still there are some signs of a role for geography. There are 18 countries out of 75 that rank in the top 25 by all three of my growth performance measures. And there arc 17 countrics that rank in the bottom 25 by all three measures. Looking at these countries on the map reveals that the strong performers are mostly in two groups. The first group consists of countries that are on the European rim. These countries participated less in the early European economic success and are now catching up to their European neighbors. The second group consists of Japan and the newly industrializing countries in Asia -- South Korea, Taiwan and Burma. (Hong Kong is not in my data set and Singapore looks very strong for labor productivity but weaker for TFP). Looking forward in time, one can see other countries in that same region that will soon join the club, notably China.[23]

The slow growers, with large negative TFP residuals, are concentrated in Africa and the Caribbean, with Bangladesh, Sri Lanka and New Zealand being the others.

Both in the traditional literature on economic development and in the recent explosion of literature on externalities, geography is often stressed as an important factor in economic performance. In the literature on cross-country growth it is not usually given much prominence,however.[24] One reason for this perhaps is that no one wants to brand particular regions or countries as being culturally unsuited to growth. But one can believe in the importance of geography without believing that certain countries are unable to grow. Just because a region has not been able to grow rapidly in the past, this is not a reason to think that this region will be unable to develop in the future. After all, the fast growers.of south east Asia were backward and apparently unsuited to growth only a few years ago.

The geographic pattern of growth has become an important part of the argument that there are externalities in the growth process. If there are spillover benefits from growth, these will create a region of growth. The nature of these spillovers is not at all clear, however, and a lot depends on this.

An obvious implication of the geographic pattern of growth is that transportation and communication costs are important. If Germany develops an industrial base, then Belgium

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[23] One country in Africa makes the fast grower group, Tanzania. Tbis is a puzzling case, since per capita income growth as reported by the World Bank is actually negative for Tanzania. If population growth is much faster than labor force growth, then it is technically possible for a country to look strong in productivity while having negative per capita income growth, but the data for Tanzania need to be investigated. Botswana, a candidate for the fast growth group, is not in my data set.

[24] Sometimes there are broad regional dummies added to the specifications, and these often perform strongly.

and Holland do also. Producers in these countries can supply parts or services to Germany. They can learn of the technology being used there. They are the recipients of direct foreign investment.

This argument is not watertight, however. The industrial revolution started first in Britain and then spread very quickly to Australia and the U.S. Indeed these countries surpassed Britain in per capita income by the end of the nineteenth century. These countries are hardly geographically proximate to Britain. The common language and institutions surely played an important role in the rapid spread of industrialization. The closest country to Britain geographically was France and there economic development was slower. Canada and Mexico are both proximate to the U.S. and yet Canada has per capita income close to the U.S. level and Mexico does not.

Britain's growth suffered in the twentieth century as economic regulation and labor conflicts grew and these problems were also transmitted to Australia, which retained close links to the U.K. There was a much smaller impact of these changes in the U.S.

The geographic evidence is hardly conclusive, but it suggests that a combination of institutions that are compatible with growth and an ability to transfer technology are the main reasons for the geographical pattern of growth. The U.S., with immigrants from throughout Europe, was particularly well placed to transfer technology in the nineteenth century. And Europe received technology from the U.S. in the twentieth century.

This view does not imply that institutions are immutable. In the 1950s it may have been very hard for countries in South East Asia to see how to adapt their institutions to Western capitalism. But oncc Japan had madc thc transition, this became a much more real possibility and the political will to change and to institute policies that are conducive to growth was created. The countries of Africa that had been subject to colonial rule also found it hard to adopt Western policies that fostered capitalism and the absorption of Western technology. Many of them tried socialism or their own brand of nationalism instead. If successful examples of sustained growth can be created in Africa, then perhaps the lessons will spread to other countries in that region.

Summary of Lessons from the Data

Given a choice among the alternatives of old growth theory, old theory modified by education and new theory, this review of the data indicates that the old growth theory does least violence to observation. A standard Cobb-Douglas production function with capital and labor and constant returns to scale is consistent with the data. The case for assigning a large role for education capital accumulation is weak and I did not find much support for the new growth theories.

On the other hand, saying that the old growth theory is consistent with the data is very different from saying that it really fits the data. Describing the countries in this sample as if they were following well-behaved neoclassical paths of convergence to steady states does not seem valid. Many or even most of the poorest countries in this sample experienced slow rates of labor productivity growth and negative rates, of TFP growth. Many countries emphasized human capital accumulation and there is little sign that this heavy investment paid off.

And convergence is a weak force. There were a modest number of countries for whom things went right and they were able to take advantage of the opportunity for convergence that must exist for a country well below the frontier. For many other countries, however, economic performance has gone badly wrong. They have been moving away from the frontier. None of the existing growth models provides an adequate framework for understanding their growth paths. /

Robert Lucas pointed to the difficulties in the old growth theory by asking why capital does not flow to developing countries like India. There is a rather simple answer to that question. India refused to admit foreign direct investment (the form of capital transfer that carries technology with it) except under very limited conditions. When this restriction was lifted in 1991, the flow of such capital rose by a factor of 10 within a year.

Institutions and Productivity in Developed Economies

Over the past few years I have been involved in case study comparisons of service sector and manufacturing sector industries in the U.S., Europe and Japan.[25] These studies have compared levels of productivity among these countries and they have revealed important reasons why levels of productivity differ. None of these countries has productivity gaps as wide as the one between the U.S. and India, but the lessons are still relevant. Based on these studies I will argue that institutional differences drive productivity differences.

In the case study comparisons we ordered the causal reasons for productivity differences hierarchically. We started at the production process level to see how the processes differed among the countries. We then asked why the differences in operations that

[25] McKinsey Global Insitute (1992) and (1993) and Baily (1994).

we had observed had come about.

At the production process level the main differences were as follows.

- The plants in some industries used craft technology that was much smaller in scale, lower in capital intensity and used an old technology compared to the modern large-scale industrial processes in high productivity plants. The productivity differences were the result of scale/capital/technology differences, with the three elements hard to separate. Food processing in Japan and beer production in Germany were examples where craft production is still prevalent.

- Productivity differences in retailing are driven by the evolution of formats. Stage one retailers are small mom and pop stores. These give way to stage two retailers such as supermarkets, department stores and discounters like Walmart or warehouse stores. Stage three retailers focus on a narrow part of demand and include Toys R Us and Banana Republic. Productivity increases as the industry evolves. Japan's retail employment is heavily in stage one stores with very low productivity.

- Some industries used product designs that resulted in lower productivity assembly operations compared to,best practice. Auto assembly in the U.S. and Germany, and consumer electronics in Germany and in the U.S. operations of European companies were examples. (The U.S. auto industry started to change in the 1980s and the German industry is now changing).

- Several industries had production processes that used more labor to perform similar tasks than that used in the best practice industries. Some industries had not developed "lean production" methods. Examples included the auto industry in the U.S. and Germany; banking in Germany and the U.K.; airlines in Europe; telecommunications in Japan and Europe; beer production in Japan; integrated steel mills in the U.S.

- In some industries there were technology differences that affected productivity but were not associated with the shift from craft to industrial technology described above. Examples include the lesser use of information technology in German and U.K. banks; the lack of minimills in Germany; the use of outdated technology in telecommunications in Germany and the U.K.; and the failure to use production line methods in metalworking in Germany and the U.S. In some cases the best practice technologies required higher capital intensity, but in others they did not.[26]

[26] In metalworking, for example, Germany has as much capital per worker as Japan. The Japanese productivity is much higher because the capital is linked into a production line rather than being a series of separate batch processes. Minimills require a smaller capital investment per ton of steel than integrated mills. They save capital per ton of steel but they save even more labor, so the capital per worker is higher in minimills.

These case studies reveal that the standard factors used in production functions do play an important role in explaining productivity differences. Capital and technology are important in some cases, but overall capital intensity differences were not a major determinant of productivity differences. Capital intensities are pretty similar across the countries and yet productivity differences are quite substantial. The U.S. auto assembly industry, for example, has spent more on capital than the Japanese industry, but ended up with lower productivity. Capital investment is often a facilitator of the adoption of best-practice methods. Just adding more capital to an cxisting production process runs into diminishing returns quickly. The intangible capital embodied in design of products and production processes was very important, although it was often the case that more resources spent on R&D was not as important as directing the resources in the right way.

Moving to the next level in the hierarchy of explanations, we found that there was little sign that lack of access either to technology or to funds for capital investment were the reasons for the productivity differences. To give examples, the machinery used in U.S. and Japanese breweries is largely made in Germany but not used there by most breweries.[27] Toyota is by far the productivity leader among auto assemblers. Its cars are on average much easier to assemble than other producers' and their production process uses less' labor. Their cars have always been available for competitors to examine, and their factories have been open to visitors. General Motors has had full access to the Toyota production system through

[27] We were told by industry experts that German beer could be brewed at industrial scale without a reduction in quality. The ingredients and process might differ from that used in large U.S. breweries, but similar productivity could be reached. The fragmentation of the industry and the very strong preference by German consumers for locally produced beer is the reason for the low productivity. Myths abound about beer, which is produced by a fairly simple chemical process.

its joint venture in Freemont California. The same was true even in computers. The U.S. is the innovation leader in this industry, but the great bulk of production is in standard mainframes and PCs and this technology is available to all of the main producers.

One important reason that technology and capital are readily available is that leading companies set up transplant operations. IBM has operations in both Japan and Germany. The U.S. auto, consumer electronics and metalworking industries have been either heavily impacted or (in the latter two industries) largely displaced by transplants.

Given that access to capital and technology is not the reason for productivity differences, what is? The case studies revealed that institutional differences were crucial, notably the regulatory environment. Industries that have vigorous domestic competition; allow or encourage international competition; that allow or encourage foreign direct investment; and that permit the evolution of industry structures will have high productivity.

Some examples are as follows. In retailing in Japan, zoning laws and laws to protect small stores prevent the evolution of retailing formats and maintain low productivity. Airlines in Europe are often state-owned and are protected from competition by bilateral monopolies. Minimills were held back in Germany by European Community rules. The steel and auto industries in the U.S. had low competitive intensity. German manufacturing industries had very high productivity in 1980 relative to other European countries. They exported very successfully within Europe but did not face full Japanese competition from best practice producers because of trade restraint agreements in Europe. Their productivity fell behind best practice in the 1980s.

Japan provides a good test of this hypothesis. Overall, Japanese competitive intensity

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is low because the competition from new suppliers is often restrained. Average productivity for the economy as a whole is also low, well below the U.S. level. At the same time, in a segment of manufacturing, Japan has encouraged vigorous domestic competition. And while foreign competition has been restricted in the domestic market, these industries have competed aggressively against best practice producers in the U.S. In these industries productivity in Japan has overtaken the U.S. level.

One sign of the importance of the institutional environment is the fact that many industries operate with excess labor. Airline managers in Europe know they have more employees than they need but they are constrained by restrictions on layoffs and are protected by state ownership and weak competition.

A major barrier to increased competition in Japan is the distribution system. Multinationals such as Coca Cola and Procter and Gamble have spent years and large sums finding ways to invest in Japan and then distribute their products. Distribution costs are very high and the system is not open to new competitors.

Productivity differences as large as the three to one ratio between the U.S. and Japanese food processing industries can exist even though the technology is available world-wide and raising funds for capital expenditures on either the Japanese or world-wide capital markets would not be a problem. It is the institutions and especially the regulatory environment that are responsible.

Evidence from Latin America

The comparisons of productivity that I have just described have now been extended in part to Latin America. The results provide an opportunity to determine whether the emphasis on institutions in determining economic performance holds up in a group of developing countries." The new report applied the methods of the earlier studies of service sector and manufacturing sector productivity to four industries (steel, processed food, retail banking and telecom) in Argentina, Brazil, Colombia, Mexico and Venezuela. It does not examine productivity growth except over very short periods, but the productivity level comparisons give important insight about why these Latin American economies have not been more successful in catching up to the U.S. level of productivity.

Figure 1 shows labor productivity for the five countries and four industries, with productivity expressed in relation to the U.S. level. With the partial exception of telecommunications, productivity levels are much lower in this sample of Latin American industries than in the U.S. These industries are more or less in line with the relation of overall productivity in these countries to the U.S. level. Why do the large productivity differences occur?

Food Processing The differences in productivity in this industry are the result of large differences in production techniques. In Latin America there are very large numbers of small food processing establishments that use relatively little capital equipment relative to operations in the U.S. (see Figure 2). The low productivity is the result of very low capital intensity and the use of technology that is obsolete compared to that used in the U.S. These two elements are linked since the technology is embodied in the capital.

Why is capital intensity so low? The study suggests that in part there are artificial

[28] McKinsey Global Institute (1994)

barriers to the use of more productive technologies, but in part the choice of technology simply reflects the very low cost of labor. There are very high import barriers that make food processing machinery (and other machinery) expensive. In addition, there are very high borrowing costs for the small companies that dominate the industry. Combining the two effects makes the rental cost of capital very high indeed. Since labor costs are relatively low, the effective wage-rental ratio is much lower than the ratio in the U.S. and the choice of low capital intensity is driven largely by factor prices at the firm level.

To a considerable extent, therefore, low productivity in this industry is a reflection of a low capital intensity at the national level, consistent with standard views of economic development. But in addition, the import duties on capital goods have distorted prices and the prohibitive borrowing rates are partly the result of a very inefficient financial intermediation process (note the productivity figures in banking) that creates an intermediation margin of 10 percentage points between borrowers and lenders.

Even though the industry in Latin American is very competitive, with many different companies, there were restrictions on imported processed food and on direct foreign investment that prevented this low productivity industry from being changed through the entry of global companies.

Retail Banking The productivity gap between the banking industry in the U.S. and the industry in Latin America was found to be the result of low competitive intensity, that is caused in turn by elaborate regulatory controls and the presence of large government-owned institutions. The banks in Latin America are large and very rigidly organized with complex procedures set up to run their employment-intensive bureaucracies. There is also a low level

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of usage of information technology.

In this industry, it is again the case that capital intensity plays a role. But to characterize the industry as one that is simply short of capital or technology is not correct. The main reason for the low productivity, and indeed a main reason for the limited use of information technology, is that there is little competition and the companies have little incentive to innovate or change.

Steel The technology of steel plants in Latin America is in line with that of steel industries in the industrialized world. There are many integrated producers with plants built in the 1960s and 70s, about the same time as plants in Europe. The U.S. integrated mills are older, while there are more modern plants in Japan and Korea. Figure 3 summarizes the status of technology in the integrated mills in the four regions.

Integrated mills are subject to increasing returns to scale up to about 3 million tons of steel a year but few plants outside Japan achieve this scale. The average scale of integrated mills in Brazil and Mexico is close to the U.S. level, although Argentina and Colombia have inefficiently small scale operations (see Figure 4). Minimills achieve full scale benefits at about 250,000 tons and the countries differ in the extent to which they achieve this level (see Figure 4).

Overall, the capital investment levels in the steel industry in Latin American compare favorably with those in Japan and the U.S. (see Figure 5).

In the study of productivity in developed economies we found that productivity in the steel industry in Japan is about 45 percent higher than in the U.S. Most of this was the result of the more modem advanced technology in the integrated mills, and the rest was due to more efficient use of labor in Japan. Comparing Latin America to the U.S. there is no large technological disadvantage in the Latin American industry, and only a modest scale disadvantage.

Overall, productivity in the steel industry in Latin America is lower than that in the U.S. because of inefficient use of capital and labor. The industry is one that has been heavily protected and where there is substantial state ownership. In particular, the investment process has been very inefficient. For example, in 1978 a rolling mill was purchased in Brazil but this has never been completed. $700 million has been invested while the cost to complete the investment today would exceed the cost of starting over with a newer mill. In Venezuela, a seamless pipe plant is under construction for $1.2 billion. An equivalent plant could be built for $350 million. There are additional examples in both Argentina and Mexico of investments that have never been completed or made operational.

As well as wastage in the capital investment side, there were significant inefficiencies found in the organization of the labor forces. McKinsey estimated that productivity *in the industry in Latin America could more than double without significant new investment.*

Telecommunications The telecommunications industry in Latin America has undergone substantial change in recent years. In several countries there has been an increase in competition and a move towards privatization. Productivity in the industry was closer to U.S. levels than in the other industries examined. To the extent that productivity was lower in Latin America this was because of excess labor in companies that had been or still were monopolies, inefficient investment decisions, and lower quality of service provided to the customer.

The productivity differences in Latin America were not closely associated with ownership structure. The telecom industry in Colombia was the most efficiently run within the group of countries and this industry remains, for local service, state owned and a monopoly. Of all of the industries in all of the countries studied in the McKinsey productivity reports, telecom is the one where state ownership seems to carry the smallest productivity penalty. This makes sense in that even the privatized companies are often monopolies (for example, the local phone companies in the U.S.). It seems also to be the case that some countries (France and Colombia) have made efficiency in telecom a priority of policy and have succeeded to some degree.

Conclusions on Latin American Productivity

The lesson from the Latin American case studies is that low productivity is the result of a combination of old growth theory reasons (low capital intensity linked to embodied technology) and institutions, notably the regulatory and competitive environment.

The food processing case study suggests that the *potential* marginal productivity of capital in Latin America is very high indeed. The reason that capital has not moved quickly to these countrics is that industry regulations and restrictions on direct foreign investment discouraged the flow. Food processing is typical of much of Latin American manufacturing industry and it indicates that there is a potential for very rapid growth in this sector if institutions change. And to a degree they are changing. Latin America is liberalizing and capital is beginning to flow there in response to the high profit opportunities.

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The other case study industries indicate that a shortage of capital is far from the only reason for low productivity in Latin America. Capital investments were often wasted completely, as evidenced by steel. Industries like banking have been used to create employment, they have not been exposed to competition. Manufacturing industries have been protected against international competition.

One finding of the McKinsey study was that a shortage of skilled production labor is not a significant reason for low productivity growth. The Latin American industry experts concluded that workers were adequately skilled to achieve vastly higher- productivity levels. Such a transformation of production processes would require substantial on-the-job training, as is also the case in developed countries.

Conclusions

It is common sense that in order to transform an agrarian economy with craft or traditional methods of production and uneducated workers into a modern industrial society will require high levels of investment in physical capital and an improvement in the school attendance rate. These things are surely necessary for success and countries that have grown rapidly will show evidence of having made these changes. The World Bank study of rapid growth in south east Asia[29] confirms this common sense.

But the evidence of a broad cross-section of countries and the evidence of the industry studies show that pushing on capital and education is not always the answer. Many countries that were very successful in raising their stock of educational capital did not achieve growth.

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[29] World Bank (1993). See also Alwyn Young (1994) and references to his prior work.

In Latin American, capital has been wasted. The skills of the workforce are not being utilized. If Latin America gets the institutions right and the incentives right, the investment will be available from the world capital market and companies will train workers, as they do in developed countries.

The World Bank report stresses the importance of "Using Resources Efficiently." Based on the studies of developed economies and of Latin America, this should have been the first chapter, not the sixth one in the report.

This paper has considered the extent to which recent developments in growth theory have explained which countries have developed successfully and which have not. The conclusion is that neither has done this very well. Although the evidence that institutions have been more important is fragmentary, it is still suggestive that a new approach is needed to growth theory if it is to be applied successfully to developing countries.

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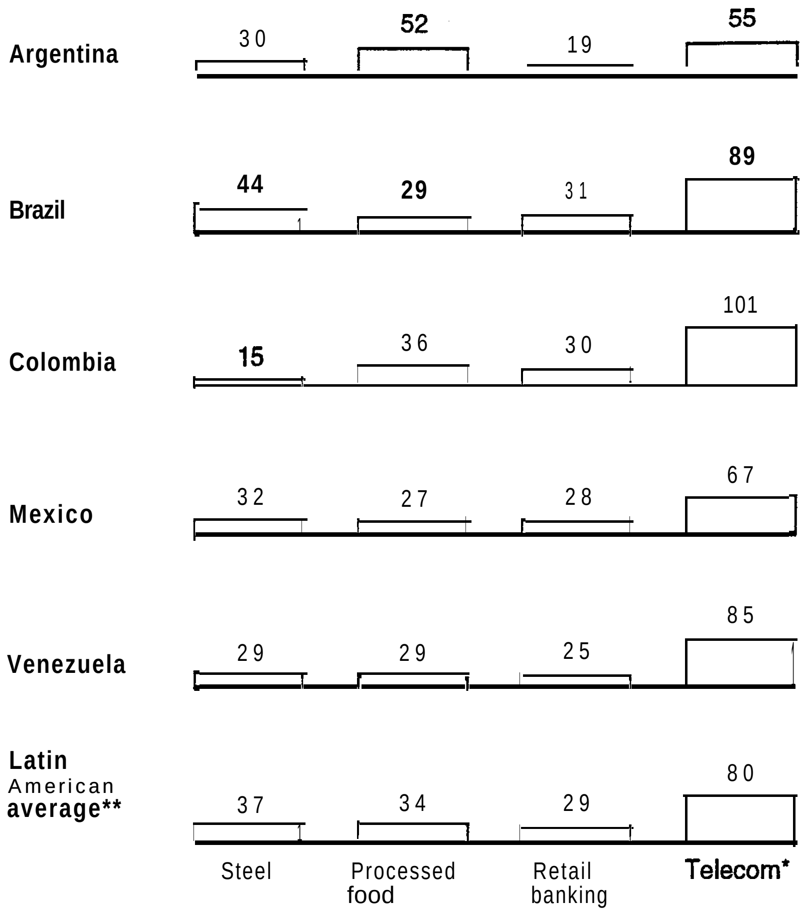
Table 1: Mean, Standard Deviation and Range of Measures of Economic Growth 75 Countries, 1961-88

	Mean	Standard Deviation	Range
Labor Productivity	1.92	1.46	7.11
Solow	0.06	1.17	5.71
MRW	-0.03	1.60	7.92

Source: Computed by author from data provided by Fischer.

Figure 1
LABOR PRODUCTIVITY COMPARISON
Index: U.S. = 100, 1992



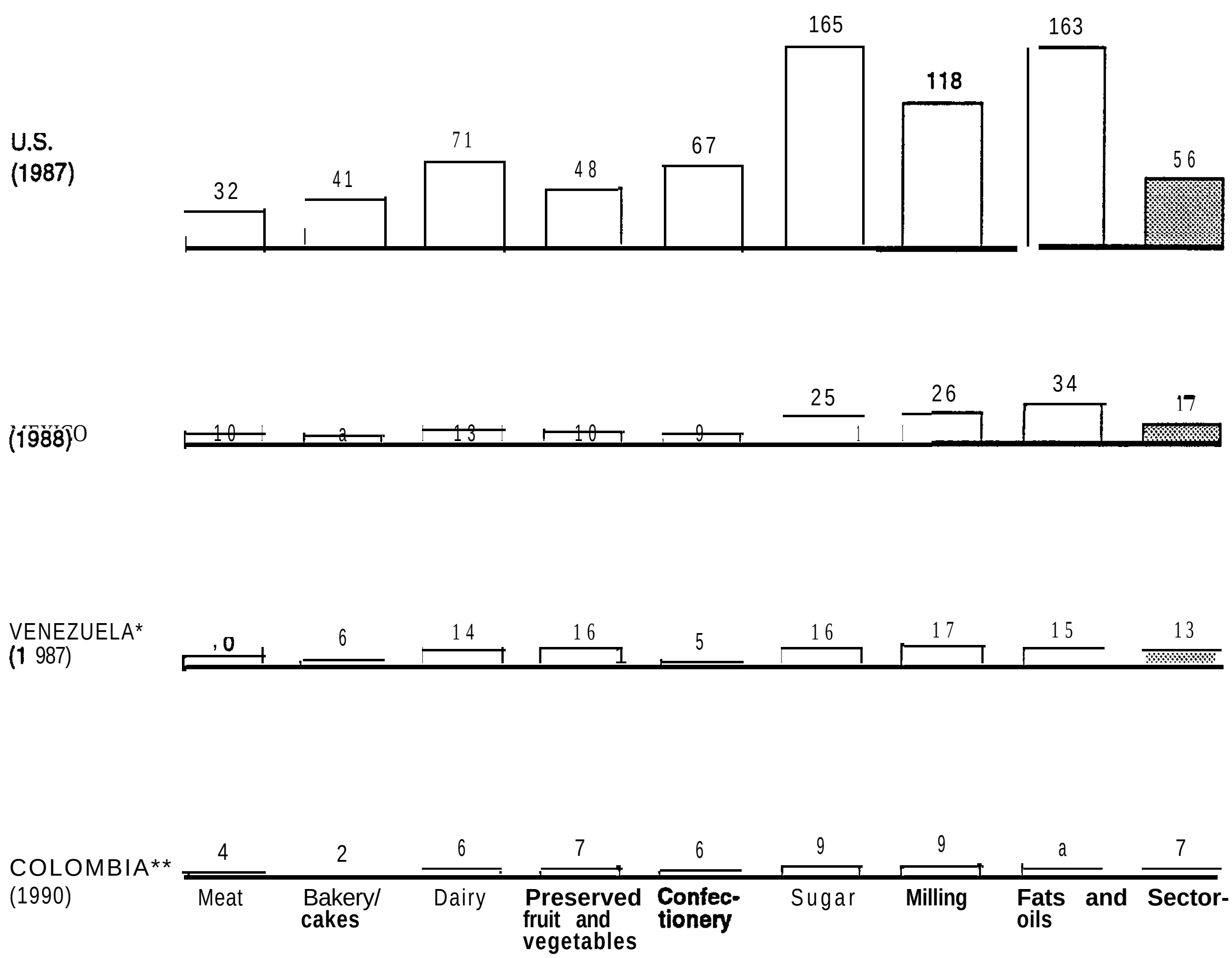
* Total factor productivity shown for telecommunications, unadjusted for quality differences
** Weighted by employment
Source: McKinsey Global institute (1994)

Table 2: Correlations Among Growth Measures

	Labor Productivity	Solow	MRW	Education Per Worker	Capital Per Worker	Labor Force
Labor Productivity	1	0.747	0.664	-0.112	0.604	-0.218
Solow		1	0.897	-0.354	-0.078	-0.098
MRW			1	-0.720	-0.074	-0.183
Education Per Worker				1	-0.246	0.154
Capital Per Worker					1	-0.175
Labor Force						1

Source: Same as Table 1

Figure 2
FIXED ASSETS PER EMPLOYEE: FOOD PROCESSING
1993 U.S. $ Thousands



* Plants with more than 5 employees
. * Plants with more than 10 employees
. * Excludes bakery/cakes

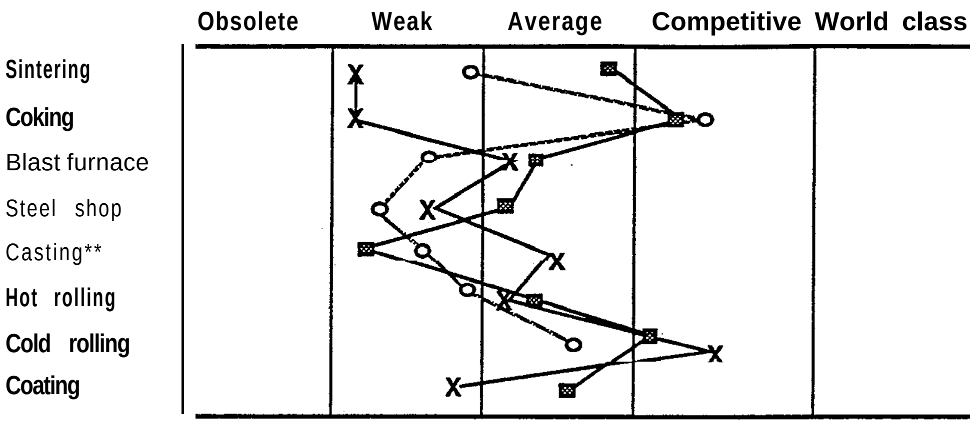
Note: The value of fixed assets reflected in the Census for Mexico reflects the market value; in Venezuela and Colombia there were no standard procedures to adjust the value of fixed assets for inflation until 1992; each company used its own method to make the adjustment, and these are the values showed in the census

Source: Census of Manufactures; McKinsey Global Institute (1994)

Exhibit 3a

TECHNOLOGICAL RANKING OF INTEGRATED SHEET STEEL FACILITIES* LATIN AMERICA

X–X Argentina
▩–▩ Brazil
O–O Mexico



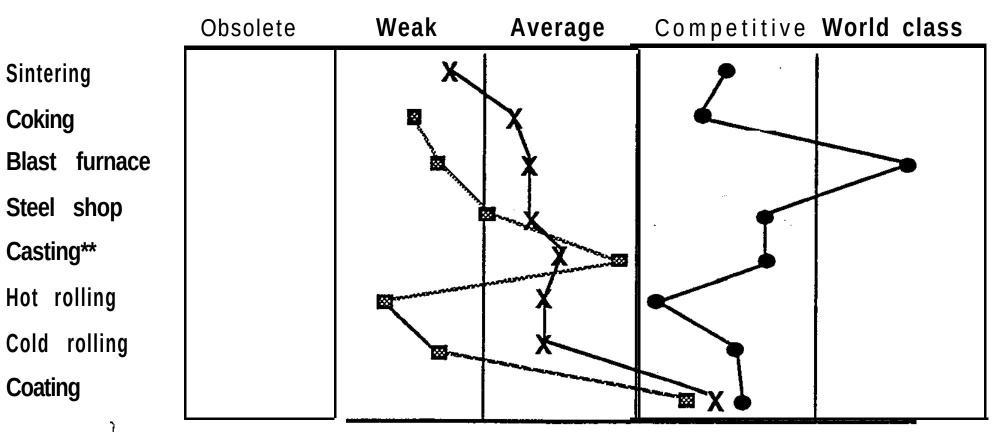
* Evaluation of Latin American installations based on year of construction and annual capacity
** Continuous casting ratio and quality of casters

Source: McKinsey Steel Practice; McKinsey Global Institute (1994)

Exhibit 3b

TECHNOLOGICAL RANKING OF INTEGRATED SHEET STEEL FACILITIES* DEVELOPED COUNTRIES

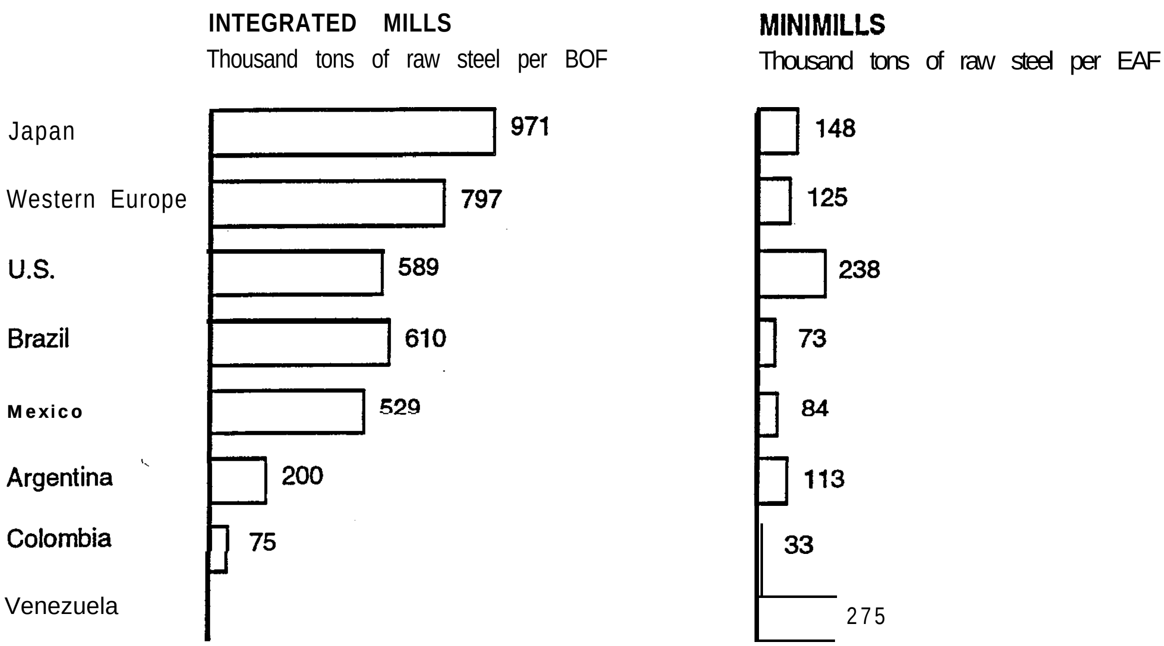
▩–▩ U S A
X–X Western Europe
●–● Japan



* Evaluation of 1200 installations based on year of construction and annual capacity
** Continuous casting ratio and quality of casters

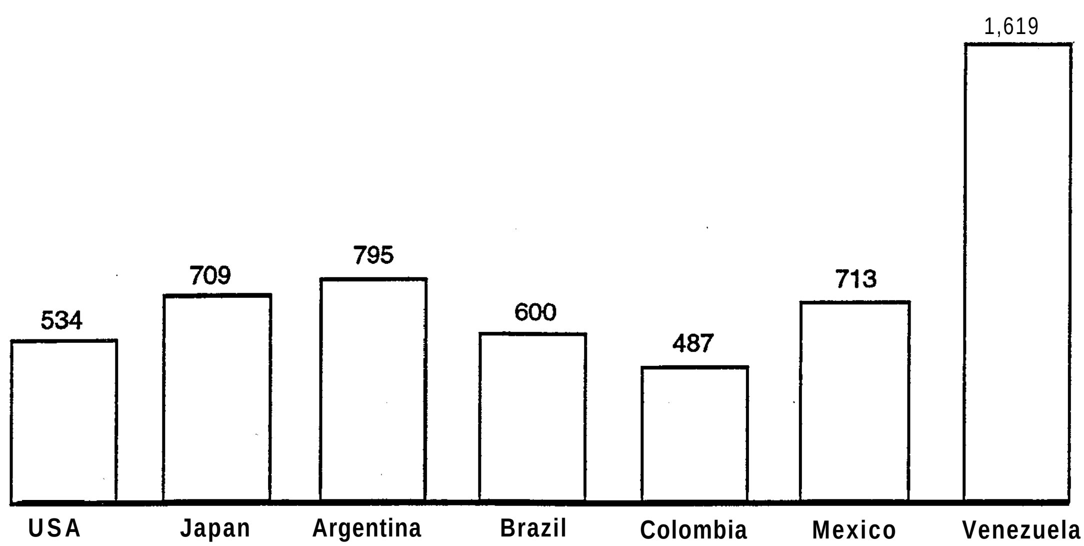
Source: McKinsey Steel Practice; McKinsey Global Institute (1994)

Figure 4
SCALE DIFFERENCES IN THE STEEL INDUSTRY



Source: McKinsey Steel Practice: McKinsey Global Institute (1994)

Figure 5
CAPITAL INVESTMENT IN THE STEEL INDUSTRY
Capital stock* per ton of raw steel shipped



- Stock accumulated from 1976 to 1992 applying depreciation based on a useful life of 35 years Investment numbers are expressed in 1992 dollar; output is taken as the average production for the last 5 years

Source: ILAFA, IISI; McKinsey Global Institute (1994)

Appendix Table AI : Rankings of Countries by Several Growth Indicators, 1961-l 966

Country	-co&3	MRW residual	Solow residual	GDP per worker	capital stock	capital per worker	educational capital	eduactional level	initial (1961) level of education	initial (1961) GDP per capita	labor force
"TANZANIA	41	1	4	24	56	65	75	75	47	75	22
"JAPAN	90	2	7	3	8	6	61	60	12	25	61
"BRAZIL	69	3	1	7	22	36	34	42	48	34	17
"MALTA	120	4	2	6	23	19	57	56	17	44	5
"TAIWAN	103	5	3	1	4	5	23	29	32	59	15
"GREECE	114	6	5	5	28	9	64	46	24	33	73
"ITALY	118	7	8	13	51	31	65	57	25	16	69
"FINLAND	111	6	12	15	52	34	69	64	5	15	68
"ISRAEL	09	9	9	19	36	50	39	53	10	19	16
"SPAIN	125	10	11	8	30	17	56	34	37	24	67
"PORTUGAL	124	11	10	11	32	27	48	22	58	40	60
"PANAMA	62	12	16	16	19	29	38	45	26	43	21
"BELGIUM	108	13	21	23	64	42	71	61	8	12	71
TURKEY	128	14	15	12	24	23	42	33	57	41	52
"GERMANY, WEST	113	15	29	25	53	30	74	71	6	8	74
"BURMA(Myanmar)	82	16	6	22	62	60	24	12	69	74	47
"AUSTRIA	107	17	20	14	40	15	63	36	29	17	75
"NORWAY	122	18	14	21	55	47	44	25	11	10	56
"KOREA,SOUTH(R)	92	19	17	2	3	3	12	11	28	61	25
"COLOMBIA	71	20	22	35	46	63	43	51	38	35	29
"ECUADOR	72	21	19	28	42	48	31	35	36	45	23
"ICELAND	116	22	24	34	44	51	47	54	15	13	33
"FRANCE	11i	23	26	18	33	21	60	44	23	11	66
"THAILAND	104	24	28	10	7	8	28	30	35	58	27
"SWEDEN	126	25	31	32	59	43	67	66	7	6	64
"KENYA	21	26	13	42	70	74	11	13	61	69	2
"MAURITIUS	28	27	16	38	67	68	25	24	39	31	24
"IRELAND	117	28	37	27	37	22	66	62	14	22	65
"AUSTRALIA	131	29	33	43	50	56	63	67	3	5	36
"U.K.	129	30	35	31	57	8	72	65	9	7	72

Appendix Table A1: Rankings of Countries by Several Growth Indicators, 1961-1988

Country	code	MRW residual	soiow residual	GDP per worker	capital stock	capital per worker	educational capital	eduactional level	initial (1961) level of education	initial (1961) GDP per capita	labor force
"UGANDA	44	31	27	60	74	75	30	38	64	73	10
"NETHERLANDS	121	32	34	37	49	45	52	43	13	9	55
"ZIMBABWE	47	33	25	46	60	67	18	26	49	60	13
"BOLIVIA	68	34	45	57	63	62	58	70	43	55	40
"U.S.A.	66	35	39	52	66	63	50	55	2	1	44
"SWITZERLAND	127	38	49	39	47	33	68	69	16	2	6
"SINGAPORE	100	37	50	4	1	2	20	27	44	29	12
"PARAGUAY	74	38	47	29	11	13	37	47	33	50	14
"CANADA	50	39	42	50	45	58	40	52	4	3	19
"VENEZUELA	70	40	23	55	61	73	10	15	40	20	1
'ALGERIA	1	41	30	30	29	39	21	14	68	46	37
"PHILIPPINES	98	42	40	33	25	35	32	31	27	51	32
"CHILE	70	43	44	61	72	69	51	58	19	23	42
"PAKISTAN	97	44	38	20	12	12	17	19	70	65	31
"SOUTH AFRICA	38	45	46	44	39	44	49	48	31	26	39
"HONDURAS	58	46	32	40	35	62	16	20	53	63	9
"COSTA RICA	51	47	48	49	26	46	33	49	21	32	5
"GUATEMALA	56	48	36	45	48	57	29	23	59	42	34
"URUGUAY	77	49	56	63	75	61	73	68	22	18	70
"ARGENTINA	67	50	54	58	65	49	62	63	18	21	59
"PERU	75	51	43	59	58	64	27	28	34	30	26
"MEXICO	60	52	53	48	20	41	22	37	46	27	4
"DOMINICAN	53	53	52	36	14	26	26	32	42	53	18
"JAMAICA	59	54	51	65	73	71	45	41	45	39	45
"MALAYSIA	94	55	57	17	5	7	14	18	41	37	11
"NEWZEALAND	133	56	60	68	54	55	59	72	1	4	43
"INDIA	85	57	55	47	38	40	36	21	56	68	53
"MALAWI	25	58	59	41	13	11	41	40	55	71	38
'SRI LANKA	101	59	85	56	15	18	46	39	3c	48	48
'SENEGAL	34	6a	71	71	18	28	70	74	54	52	28

.dix Table A1: Rankings of Countries by Several Growth Indicators, MI-1988

Country	code	MRW residual	Solow esidual	GDP per worker	capital tock	capital per worker	educational capital	eduactional evel	initial (1961) level of education	initial (1961) GDP per capita	labor orce
"IRAN	87	61	41	26	10	16	4	4	66	36	7
"TRINIDAD&TOBAG	65	62	69	64	31	32	54	59	20	14	49
"NICARAGUA	61	63	67	72	41	54	35	50	52	38	8
"EL SALVADOR	54	64	58	66	43	59	13	17	50	49	6
"CAMEROON	7	65	61	9	2	1	6	7	65	68	54
"MOZAMBIQUE	30	66	72	75	69	70	55	73	62	47	30
"ZAIRE	45	67	64	62	34	37	9	8	63	72	51
"GHANA	17	68	62	73	68	68	5	6	60	56	41
"SIERRA LEONE	36	69	86	54	27	14	8	5	72	62	63
"ZAMBIA	46	70	70	74	71	72	15	16	51	54	20
"SUDAN	39	71	73	69	16	24	7	9	74	57	35
"HAITI	57	72	75	67	6	4	19	10	71	64	58
"IRAQ	88	73	69	51	9	10	2	2	67	28	3
"MALI	26	74	74	70	17	20	3	3	75	70	50
"BANGLADESH	81	75	83	53	21	25	1	1	73	67	46